Appendix B: Wyoming Guideline No. 15

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WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
GUIDELINE NO. 15

ALTERNATIVE SEDIMENT CONTROL MEASURES

This document is a guideline only. Its contents are not to be interpreted by applicants, operators, or LQD staff as mandatory. If an operator wishes to pursue other alternatives, he or she is encouraged to discuss these alternatives with the LQD staff.

I. INTRODUCTION

This guideline identifies specific sediment control measures that may be used in addition to or in place of sedimentation ponds. Operators should note that alternative sediment control design requirements are minimal for areas less than 30 acres. Monitoring requirements are also minimal for small ephemeral receiving streams (drainage areas less than 0.5 square miles). Land Quality Division (LQD) will rely on field inspections of small areas, focusing on construction and maintenance to ensure their effectiveness.

These recommendations do not constitute the only acceptable alternative sediment control techniques. LQD intends to maintain flexibility so that they can evaluate sediment control systems not envisioned in this guideline. The final sediment control system should conform to the standards described herein for design, construction, maintenance, and monitoring.

Even where sedimentation ponds are constructed, alternative sediment control changes can be used to minimize sediment delivery to ponds and thereby decrease the frequency of pond maintenance. Alternative techniques are especially applicable to large reclaimed watersheds, where erosion must be controlled before a downstream pond is eliminated.

II. Objective of Alternative Sediment Control Measures (ASCM's)

Alternative sediment control measures are presented as an option other than the use of sedimentation ponds in the WDEQ/LQD Coal Rules and Regulations when it can be demonstrated that they "will not degrade receiving waters" (Chapter IV, Section 2.(f)(I)). Receiving waters are defined by the LQD as:

1. Any unimpounded and undisturbed or permanently reclaimed stream outside of the permit area that is within three (3) channel miles downstream of an area controlled by an ASCM; or

2. Any unimpounded and undisturbed or permanently reclaimed stream within the permit area downstream of an ASCM.

As stated in Chapter IV, Section 2.(f)(vii), "Appropriate sediment control measures shall be designed, constructed, and maintained using the best technology currently available to prevent additional contributions of sediment to streamflow or to runoff outside the affected land". Also, a surface water

monitoring program "...will be used to demonstrate that the quality and quantity of runoff from affected lands...will minimize disturbance to the hydrologic balance". (Chapter IV, Section 2.(I)(ii)).

These regulations suggest that there is a design/maintenance standard, **best technology currently available (BTCA),** a performance standard, **non-degradation of receiving waters,** and a verification standard, **demonstrable monitoring program.** ASCM's should be designed such that it can be demonstrated that sediment yields are not greater than background levels.

III. Best Technology Currently Available (BTCA)

A. Elements of BTCA.

The design methods, construction techniques, maintenance practices and monitoring system all contribute to a system that can be considered BTCA.

B. Determination of BTCA.

1. BTCA will be determined on a case by case basis. BTCA determinations will be based on the type of disturbance, the size of the disturbance and the length of time the ASCM will be in place. The LQD will not require the same ASCM sophistication on, for example, small temporary topsoil stockpiles or topsoil stripping areas as they will for a permanently reclaimed watershed. The determination of BTCA will be based on how effective the ASCM is at:

    a. Preventing soil detachment and erosion, using slope erosion control practices.

    b. Retaining sediment as close as possible to its point of origin, using on-slope and in-channel sediment trapping structures.

    It is preferable to use effective slope erosion control practices where possible. Sediment traps should constitute a second line of defense.

2. The LQD realizes that many technologies currently exist that can be considered the "best" technology. New technologies may be developed in the near future that may provide a higher degree of erosion protection than is "currently" available.

IV. Design of ASCM's

ASCM's can be considered for disturbed or reclaimed areas that are not within one-half mile (channel distance) of any class I, II, or III stream. (These classes are defined in the WDEQ/WQD Rules and Regulations, Chapter I, Section 4). Small areas (less than 30 acres) located within one half mile of a class I, II, or III stream, may be protected using ASCM's, subject to the discretion of the LQD administrator.

A. Designing ASCM's for Small Areas (less than 30 acres)

The only sediment control design requirements for small disturbed area (less than 30 acres) are:

1. Sediment trapping structures (e.g., toe ditches, rock check dams) should be designed to pass or detain runoff from storms of recurrence intervals determined by their expected lifetimes (see Appendix 1). A generic design may be acceptable where many similar small areas will be controlled by similar structures as long as they will withstand the design precipitation event.

2. Rocks used to construct check dams should be angular and have an appropriate size distribution so that the design peak flow cannot entrain them or else be enclosed in a staked wire mesh structure.

3. Toe ditches should be graded to a zero slope, where practical. Otherwise, toe ditches should be gently graded to a stabilized outlet that has a check dam of porous rock, staked hay bales, or a fabric sediment fence to retain sediment.

4. Detention basins will be considered alternative sediment control only when their capacity is less than 0.5 acre-foot.

5. The operator need only report the ASCM design and its justification with a planview location and a general description of the type structure to the LQD. Proposals of this size should outline the inspection and maintenance programs the operator will use to regularly evaluate the stability and effectiveness of each ASCM.

B. Designing ASCM's for Large Areas (30 acres and larger)

1. The design of ASCM's for large areas should be based on predicted sediment loads or yields from the particular area of disturbance. The operator should compare predicted or measured native sediment yields to those predicted for the disturbed area.

2. A state-of-the-art computer watershed model should be used as an ASCM design tool. The LQD will work with the operator to determine which model(s) can be considered state-of-the-art for the particular application. Section VII of this guideline includes specific model information that should be submitted.

C. Implementation Priorities for Various ASCM's

The following lists prioritize the most desirable ASCM's for each particular disturbed area:

1. Topsoil Stripping Areas

   a. Divert undisturbed water around the stripped area into an approved diversion channel.
   b. Divert drainage from the stripped area into the pit.
   c. Divert drainage from the stripped area away from the pit through an ASCM:

1. Place native vegetation buffer strips or filter cloth between the disturbance and the channel.
2. Place sediment trapping structures in channel (porous rock check dams, staked straw bales).
3. Place sediment trapping structures below the channel grade.

2. Overburden/Topsoil Stockpiles

a. Utilize a flat construction profile.
b. Locate stockpiles away from drainageways.
c. Use contour plowing, seeding and mulch on stockpiles.
d. Establish a good vegetative cover.
e. Grade contour ditch outlets to stabilized drainageways.
f. Grade toe ditches to sediment trapping structure that retains minimum amount of water.
g. Grade toe ditches to zero grade and less than 0.5 acre-foot capacity.

3. Postmining Surfaces

a. Stable landform design

Geomorphic approaches to stable landform design are highly recommended to minimize sediment yield. For example, drainage density and channel and hillslope profile shapes can be varied and lose lengths reduced to minimize sediment yield.

b. Short-term slope erosion controls

1. Regraded topsoil surfaces should be pitted with a large disc, chisel plow or ripper working along the contour to increase infiltration and detain runoff.

2. Bare rounded surfaces should be mulched and vegetated rapidly. It is highly recommended that mulch be anchored in the topsoil and that vegetation be planted immediately after surface grading. Cover crops provide a standing mulch that can be mowed prior to subsequent plantings.

c. In-channel sediment retention measures

Vegetation is often sufficient to stabilize stream channels. A rock check dam should be placed in channel reaches that produce excessive sediment from their bed and banks. Accumulated sediment should be regularly removed from rock check dams. Check dams should be used as a final resort in permanently reclaimed stream channels.

D. Location of Sedimentation Ponds

Sedimentation ponds must be used to control runoff from facilities areas, coal stockpiles

and pit drainage. Sediment ponds may also be necessary when maintenance of ASCM's is a chronic unresolved problem.

V. Construction and Maintenance of ASCM's

A. Construction of ASCM's

Each type of ASCM has construction and maintenance guidelines that are specified in most handbooks on sediment control (see list of references, Appendix 2). Some basic guidelines include:

1. Mulch must be anchored to prevent it from being washed or blown off the slope.

2. Rocks used in porous rock check dams should be the appropriate size, angularity, and density to prevent flows from transporting them or else they should be contained in anchored wire mesh.

3. Contour ditches should be constructed with a stabilized outlet and berms that are well compacted and vegetated.

4. Concentrating flow in a diversion ditch can result in severe erosion by gullying if the outlet is not adequately constructed and stabilized.

5. Baled hay check dams should be staked into the bed and banks of channels. Flow should pass over the low point of the channel. If hay bales are placed level across the channel, they should be staggered so that water will not pond behind them and be deflected into the banks.

B. Maintenance of ASCM's

The operator should report, repair and log any significant damage to an ASCM as soon as possible after the damage occurs. The operator should inspect the ASCM at the beginning and at the end of each runoff season, and after each runoff event. An inspection and maintenance log should be kept to document the condition of each ASCM at the time of each inspection. The log should describe any damage, the required maintenance, and the date repairs were made.

VI. Performance of ASCM's

A. Monitoring Ephemeral Tributary (Class IV) Streams

Where the receiving water is an ephemeral (Class IV) stream, the water quality standard set by WDEQ/WQD Rules and Regulations, Chapter 1, Section 15, is as follows:

"...substances...influenced by the activities of man that will settle to form sludge, bank or bottom deposits shall not be present in quantities which could result in significant aesthetic degradation, ... or adversely affect public water supplies, agricultural or industrial water use, plant life or wildlife, etc."

1. Small ephemeral receiving streams

   Small ephemeral receiving streams (drainage areas less than 0.5 square miles) that are receiving waters for ASCM's should be visually inspected after each runoff event.

   a. Channels and hillslopes should be inspected for signs of rill and gully erosion. The volume and location of any recently accumulated sediments should be recorded.

   b. Repeat photographs should be taken at least annually and after large runoff events at several permanent locations along the receiving stream to supplement the written record of observations.

2. Large ephemeral receiving streams

   In addition to the requirements for visually monitoring small ephemeral receiving streams, monitoring of large ephemeral receiving streams (drainage areas greater than 0.5 square mile) should include one, or both, of the following:

   a. Repeat surveys of representative permanently benchmarked stream channel cross sections located within the disturbed reach of the channel and continuing into the receiving stream channel.

   b. Upstream and downstream sediment yield monitoring stations that follow the plan set forth for Class I, II, and III streams below.

B. Monitoring Class I, II, and III streams

Any class I, II or III receiving stream should be monitored upstream and downstream of the disturbed area so that any potential increase in sediment load related to mining disturbance can be detected.

1. The methods of data collection and the analytical basis for determining whether or not degradation has occurred should be outlined in detail in the ASCM proposal.

2. Continuous flow recorders and automatic sediment samplers should be installed at permanent upstream and downstream station locations.

3. Automatic sediment samplers should begin sampling at the onset of each runoff event and continue at 5 to 10 minute intervals throughout each runoff event. Other sampling intervals or methods will be considered according to their ability to verify sediment yields.

4. The applicant should submit a monitoring station maintenance plan. Data from monitoring stations should be retrieved within 24 hours of each runoff event. Faulty equipment should be immediately repaired or replaced. Monitoring stations should be inspected by the operator after every runoff event, and a log of

monitoring and maintenance activities should be kept for LQD review. The LQD will be looking for a long-term record of maintenance as well as a company's efforts to correct problems in a timely fashion.

VII. Contents of an ASCM Proposal

The proposal for implementation of an ASCM for areas greater than 30 acres should include the following items:

A. A general description of the area to be controlled by ASCM's and the types and duration of expected disturbance include the distance to and type of nearest receiving stream and/or Class I, II, or III stream.

B. Description of the ASCM Design Procedure

1. List and justify values chosen for the watershed (or subwatershed) variables and model parameters (e.g., soils, sediment grain size distribution, slopes, etc.).

2. Where applicable, submit data used to calibrate model and the calibration results (e.g., design hydrographs, hyetographs, curve numbers, etc.).

3. Explain the choice of ASCM's.

4. Submit and justify the design storm recurrence interval and duration, runoff volume, and peak discharge.

5. Submit sample calculations and/or computer model output.

C. Provide a map of ASCM's on a mining sequence topographic map or overlay. Each ASCM should be referenced in the descriptive text and design information, and dates of construction or implementation of each ASCM should be given. This map should be updated in each Annual Report if modifications are made.

D. Provide specifications for each ASCM and a schematic diagram of each typical structure.

E. For reclaimed areas:

1. Refer to drainage basin and channel designs in reclamation plan:

a. Longitudinal profiles of reclaimed channels.

b. Typical reclaimed channel cross sections.

c. Reclaimed area contour map with 10' or less contour interval.

d. Justification of drainage basin design.

e. Reclaimed basin characteristics such as: relief ratio, drainage area, topsoil and spoil particle sizes, average channel slope. Include discussion of how reclaimed basins, slopes and channels are designed to minimize additional sediment yield to downstream areas.

2. Surface treatments (mulch, contour ripping).

3. Channel protection measures, if any.

F. Maintenance and inspection plan.

G. Monitoring plan and description of degradation analysis.

H. If any impounding structure is designed to retain more than 2.0 ac-ft of water, a WQD permit must be obtained.

I. ASCM's designed to control large disturbed watersheds (excluding isolated small areas) may need to be permitted through the State Engineer's Office (Form SW-1, Application to Appropriate Surface Water). The State Engineer's Office should be contacted directly to determine whether or not such a permit is required.

APPENDIX 1

Design Events for Temporary Structures

Exceedance of the design runoff is likely to result in destruction of in-channel ASCM's and in the remobilization of any stored sediment. Therefore, temporary structures should be designed for an event with some reasonably small probability of occurrence over the structure's lifetime.

Example:

The highest acceptable risk of structure failure during that structure's lifetime is 20%.

Table 1 shows event return periods for which the risk of failure (at least once) over a given number of years will be no greater than 20%. The return periods in Table 1 were calculated from the following equation:

$$P = 1 - (1-1/t)^{n}$$

where P is the probability that an event of return period t will be equaled or exceeded at least once during the course of n years (Linsley, Kohler and Paulhus, 1982).

Table 1 - Design Event Return Periods

Expected Lifetime of Structure (yrs)	2	5	7	10
Design Event Return Period (yrs)	10	25	33	50

Over any two-year period, a 10-year event has a 20% chance of being equaled or exceeded at least once. Therefore, based on the criterion of 20% acceptable risk of failure, the appropriate design storm for a structure intended to function for two years is the 10-year peak runoff, or predicted peak runoff from the 10-year rainfall. For structure lifetimes outside the range of those in Table 1, appropriate design storm return periods should be calculated in the same manner from the equation given above.

APPENDIX 2

References

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